

FORM PTO-1350  
(REV 11-98)ATTORNEY DOCKET NUMBER  
6009-4615TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371U.S. APPLICATION NO (if known see 37 CFR 1.51)  
TBA

10/030891

INTERNATIONAL APPLICATION  
PCT/FI00/00396INTERNATIONAL FILING DATE  
04 May 2000 (04.05.00)PRIORITY DATE CLAIMED  
14 May 1999 (14.05.99)

## TITLE OF INVENTION

METHOD AND EQUIPMENT FOR SMELTING NON-FERROUS METAL SULPHIDES IN A SUSPENSION  
SMELTING FURNACE IN ORDER TO PRODUCE MATTE OF A HIGH NON-FERROUS METAL CONTENT AND  
DISPOSABLE SLAG

## APPLICANT(S) FOR DO/EO/US

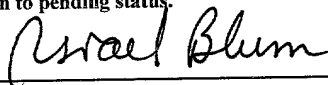
KOJO, Ilkka and KYTO, Markku

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371 (b) and PCT Articles 22 and 39 (1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☐ is transmitted herewith.
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International application into English (35 U.S.C. 371(c)(2)), with oath
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (executed)
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

## Items 11. to 16. below concern document(s) or information included.

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.  
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or Information:
  - Copy of Notification Informing Applicant of the Communication of the International Application to the Designated Offices
  - Copy of International Preliminary Examination Report
  - Copy of International Application Published Under the Patent Cooperation Treaty (PCT)  
No. WO 00/70103
  - Check in the amount of \$1,040.00
  - Return postcard.

U.S. APPLICATION NO. (if known, see 37 CFR 1.51) <b>TBA 10/030891</b>		INTERNATIONAL APPLICATION PCT/FI00/00396		ATTORNEY DOCKET NUMBER 6009-4615	
17. <input checked="" type="checkbox"/> The following fees are submitted: <b>BASIC NATIONAL FEE</b> (37 CFR 1.492 (a)-(5)):- Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1040.00  International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ... \$890.00  International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2) paid to USPTO ..... \$740.00  International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33 (1) - (4) ..... \$710.00  International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1) - (4) ..... \$100.00  <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>				<b>CALCULATIONS</b> <b>PTO USE ONLY</b>	
Surcharge of <b>\$130</b> for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$ - 0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$ 0.00	
Total claims	12-20	0	X \$18.00	\$ 0.00	
Independent claims	2-3	0	X \$84.00	\$ 00.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$280.00	\$ 0.00	
<b>TOTAL OF ABOVE CALCULATIONS =</b>				\$ 1,040.00	
Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).				\$ 0.00	
<b>SUBTOTAL =</b>				\$ 1,040.00	
Processing fee of <b>\$130.00</b> for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$-- 0.00	
<b>TOTAL NATIONAL FEE =</b>				\$ 1,040.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property =				\$ 00.00	
<b>TOTAL FEES ENCLOSED</b>				\$ 1,040.00	
				Amount to be refunded:	\$
				charged	\$
a. <input checked="" type="checkbox"/> A check in the amount of \$1,040.00 cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. 13-4500 in the amount of to cover the above fees. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 13-4500, ORDER NO. 6009-4615 . A duplicate copy of this sheet is enclosed.					
<b>NOTE:</b> Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: Morgan & Finnegan LLP 345 Park Avenue New York, NY 10154-0053 Telephone: 212-758-4800 Telecopier: 212-751-6849			 Israel Blum Registration Number 26,710		

2/PRTS

10,030891

531 Rec'd PCT/PT 07 NOV 2001

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METHOD AND EQUIPMENT FOR SMELTING NON-FERROUS METAL  
SULPHIDES IN A SUSPENSION SMELTING FURNACE IN ORDER TO  
PRODUCE MATTE OF A HIGH NON-FERROUS METAL CONTENT  
AND DISPOSABLE SLAG

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The present invention relates to a method and equipment, whereby matte with a high non-ferrous metal content and disposable slag are produced simultaneously in a suspension smelting furnace from non-ferrous sulphide concentrate. According to the invention, a carbonaceous reducing agent is charged to the lower furnace of a suspension smelting furnace via tuyeres to a section of the furnace with a reduced cross-sectional area.

It is characteristic in suspension smelting that the final phase equilibrium between the slag and matte only arises during the slag reactions taking place in the lower furnace. In other words, the potentially imbalanced over- and under-oxidized compounds formed in the reaction shaft still react with each other in the slag phase, particularly in the primary discharge point of the shaft suspension under the reaction shaft, so that the massive slag and matte phase are almost in the composition defined by their thermodynamic composition. In addition to the previously mentioned equilibrium-determining copper already dissolved in the slag, copper-rich matte, undissoluble to the slag, remains in the slag as a mechanical suspension, which does not manage to settle in a realistic time.

It is known before that slag with a low copper content can be produced in a suspension smelting furnace such as flash smelting furnace, when fixed coke or some other carbonaceous substance is used in the reduction of slag and the copper oxidule dissolving therein and especially magnetite which increases the viscosity of the slag and slows down the separation of molten matte particles contained in the slag by settling.

In US patent 5,662,370 a method is described, in which it is essential that the carbon content of the carbonaceous material to be charged to the reaction shaft is at least 80%, that at least 65% of the material particles are under 100  $\mu\text{m}$  and at least 25% between 44 -100  $\mu\text{m}$ . Particle size is defined precisely, because, according to said patent, the reduction of magnetite with unburnt coke occurs under two mechanisms and particle size is of decisive significance with regard to said mechanisms. If the rough coke powder size is about 100  $\mu\text{m}$  or greater, the particle size of the unburnt part is also great and for this reason coke remains floating on the slag surface and reactions are slow. When particle size is reduced, the powder coke enters the slag and thus comes into direct contact with the magnetite to be reduced, which accelerates the reaction rate.

In Japanese patent application 58-221241 a method is described, in which coke breeze or coke breeze together with pulverized coal are charged into the reaction shaft of a flash smelting furnace through a concentrate burner. The coke is fed into the furnace so that the entire surface of the melt in the lower furnace is evenly covered with the unburnt powder coke. According to the application, the degree of reduction of magnetite decreases when the grain size is ultra-fine, so grain size used is preferably from 44  $\mu\text{m}$  to 1 mm. - The slag layer covered by unburnt coke, which remains on the molten slag bath decreases considerably the partial pressure of oxygen. The highly reducing atmosphere arising from the coke layer causes for example damages to the lining of the furnace.

In JP patent 90-24898 there is described a method, in which pulverized coke or coal with particle size of under 40 mm is fed into the flash smelting furnace to replace the oil used as an extra fuel and maintain the desired temperature in the furnace.

JP patent application 9-316562 applies to the same method as the previously mentioned US 5,662,370. The difference from the method of the US patent is that carbonaceous material is fed to the lower part of the reaction shaft of the flash smelting furnace, to prevent said carbonaceous  
5 material from burning before it reaches the slag and the magnetite to be reduced contained therein. The particle size of the carbonaceous material is essentially the same as the distribution described in the US patent.

A weakness of the previously described methods is that the reduction area  
10 is the same where slag material and non-ferrous metallic matte come to when they settle from the reaction shaft and separate from the gas phase in the lower furnace. However, in a suspension smelting furnace, fine grained material such as copper matte particles does also drift with the gas phase to the back of the furnace and uptake. When these smallest particles separate  
15 from the gas flow in the back of the furnace and settle to the surface of the slag phase, their settling in the slag phase is very slow due to just the small particle size. Because slag mainly is tapped from the back or side of the furnace, these particles do not manage to settle through the slag phase. Instead, they drift together with the slag to be tapped out of the furnace and  
20 add to the copper content of slag.

Another weakness in some of the previously described methods is the small particle size of the coke, in that these coke particles do not settle at all from the gas phase but continue with the gas phase to the uptake and from there  
25 on to a waste-heat boiler as a reducing agent. In the boiler the coke particles react and generate unnecessary energy in the wrong place, which may even limit total process capacity as the waste-heat boiler capacity diminishes.

30 One clear disadvantage of the previously described methods is that the reducing impact of the coke and then the minimum content of the slag are

directed in an uncontrolled manner throughout the lower furnace area including particularly the area underneath of the reaction shaft, which has an essential impact on the non-ferrous metal content of the matte produced. In other words, the massive coke layer which forms on the surface of the slag phase renders the process uncontrollable. Now in the method developed, it is possible to reduce the slag further without essentially affecting the metal content of the massive non-ferrous metallic matte such as copper or nickel matte produced in the process without disturbing the slag reactions in the shaft suspension.

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In a method according to the present invention developed for non-ferrous metal production in a suspension-smelting furnace, the slag forming in a lower furnace is injected with pulverized coke or other carbonaceous reducing agent via tuyeres into an area, which does not disturb either the natural slag reactions of the suspension which discharges from a reaction shaft and the generation of matte. So the tuyere injection is either done in the area between the reaction shaft and the uptake, under the uptake or in a separate extension of the lower furnace located after the uptake. The difficulty of a tuyere injection in metallurgical processes is that its impact area is short depth-wise and in a conventional suspension smelting furnace effective impact would not be possible due to the width of the furnace. For this reason, according to the present invention, a throttle area with an essentially reduced cross-sectional area is incorporated into the furnace, where the tuyeres are located. It is essential that the slag-tapping hole is located so that the total amount of melt has to flow through this tuyere area, thereby reducing the slag. The reduction area precedes a settling area, where the matte and metal particles separated from the slag by reduction can settle. The essential features of the invention will become apparent in the attached patent claims.

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It is also known before that the viscosity of slag in slag reduction decreases with lowering of ferric iron content which increases viscosity, wherein the settling of particles separated in reduction occurs more rapidly than in a normal suspension smelting. In addition, in the method of the present invention the flows caused by the injection achieve desired turbulence in the melt, so the small particles therein which settle slowly have an improved chance of joining each other or straight to the matte phase, which in turn makes the cleansing of slag from metal more effective.

- 10 The invention is described further in the attached diagrams, where:  
 Figures 1 and 2 present schematic cross-sections of the suspension smelting furnace, where an alternative offered by this invention has been applied by positioning tuyeres on the lower furnace between the reaction shaft and uptake and  
 15 Figures 3, 4, 5, 6 and 7 present likewise cross-sections of the suspension smelting furnace, in which the tuyeres have been placed after the uptake and an own settling area has formed to the lower furnace.

Figure 1 presents schematically a cross-section of a suspension smelting furnace 1, where a reaction shaft 2, a lower furnace 3 and an uptake 4 can also be seen. In the area between the reaction shaft and uptake in the lower furnace an essentially right-angled throttle point 5 is formed, where the cross-sectional area of the furnace is decreased. A reducing agent such as coke is charged through a tuyere 6 into this neck.

25

The alternative presented in Figure 2 is essentially the same as in Figure 1, but throttle point 5 is formed more smoothly than in the previous case. In both Figures 1 and 2, the tapping holes for matte and slag are located normally at the back of the lower furnace (not shown in diagram). The settling area of the lower furnace following the throttle point is in both cases  
 30 equal to the width of the primary lower furnace.

Figures 3, 4, 5, 6 and 7 present an alternative where the neck point is formed in the area of the lower furnace after the uptake. In the case of Figure 3, the lower furnace is throttled on opposite sides and tuyeres 6 have  
5 been located on the throttle point 5. After the throttle point, there is an extension part 7, which acts as a settling area, as described earlier. The furnace structure in Figure 4 is otherwise the same as Figure 3, but the furnace has been throttled on the other side only. In the solution presented in Figure 5, the lower furnace does not have the extended settling area, but  
10 the end of the furnace is in cross-sectional area essentially the size of the throttle point. Figures 6 and 7 show that the settling area can also be formed other than in a right-angled shape. In Figures 1 - 6, the tuyeres are positioned perpendicular to the melt, but in Figure 7 the tuyeres are positioned in reverse at an angle to the melt flow. The tapping holes for  
15 matte and slag presented in Figures 3 - 7 are located at the very back of the settling area, although they are not shown in more detail.



## PATENT CLAIMS

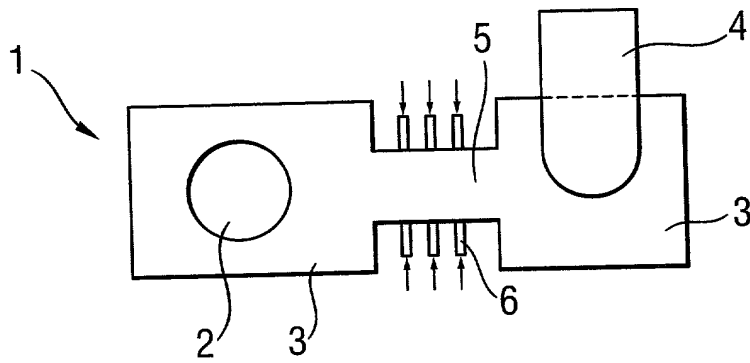
1. A method for smelting non-ferrous metal sulphides in a suspension smelting furnace, in which matte is produced with a high non-ferrous metal content and slag, which is reduced with the aid of carbonaceous material in a lower furnace for disposal, **characterized in** that the slag is reduced in a throttle point (5) formed in the lower furnace, in which throttle point the cross-sectional area of said furnace is decreased and into which a reducing agent is charged via tuyeres (6) on the slag layer.
2. A method according to claim 1, **characterized in** that the entire melt flows through the throttle point.
3. A method according to claim 1, **characterized in** that the reduction point is in the lower furnace in the area between the reaction shaft and uptake.
4. A method according to claim 1, **characterized in** that the reduction point is in the area of the lower furnace after the uptake.
5. A method according to claim 1, **characterized in** that the reduced slag is channelled to a settling area (7) before being discharged from the furnace.
6. Equipment for smelting non-ferrous metal sulphides in a suspension smelting furnace, producing matte with a high non-ferrous metal content and slag which is reduced for disposal, **characterized in** that a lower furnace is furnished with a throttle point (5) and tuyeres (6) placed therein for a reducing agent.
7. Equipment according to claim 6, **characterized in** that the throttle point is formed to an area of the lower furnace between the reaction shaft and

uptake.

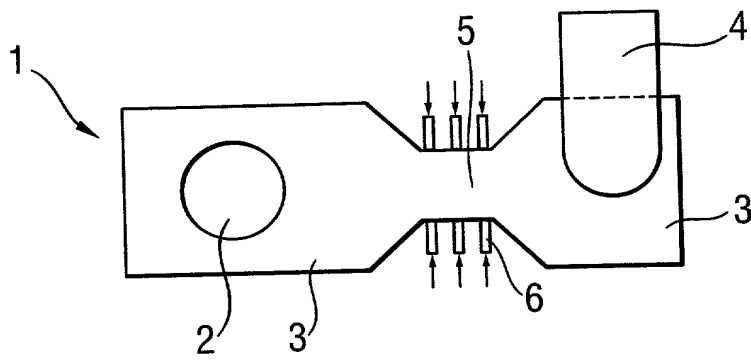
8. Equipment according to claim 6, **characterized in** that the throttle point is formed to an area of the lower furnace after the uptake.
- 5
9. Equipment according to claim 6, **characterized in** that the lower furnace is furnished with a settling area after the throttle point.
10. Equipment according to claim 9, **characterized in** that the slag-tapping  
10 hole is located in said settling area.
11. Equipment according to claim 9, **characterized in** that the width of the settling area is equal to that of the lower furnace.
- 15 12. Equipment according to claim 9, **characterized in** that the width of the settling area is equal to that of the throttle point.

The present invention relates to a method and equipment, whereby matte with a high non-ferrous metal content and disposable slag are produced simultaneously in a suspension-smelting furnace from non-ferrous sulphide concentrate. According to the invention, a carbonaceous reducing agent is charged to the lower furnace of a suspension smelting furnace via tuyeres to the part of the furnace which has a reduced cross-sectional area.

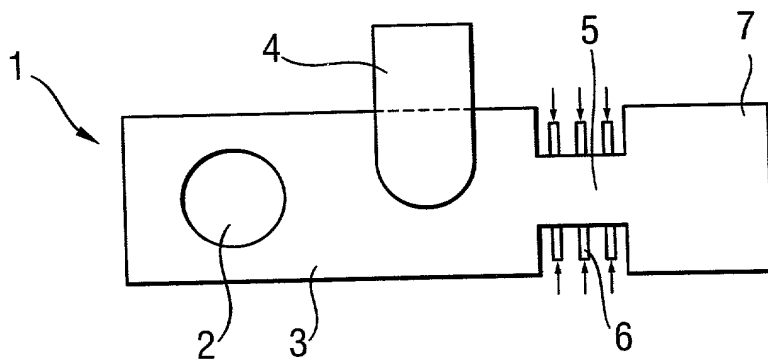
concentrate. According to the invention, a carbonaceous reducing agent is charged to the lower furnace of a suspension smelting furnace via tuyeres to the part of the furnace which has a reduced cross-sectional area.



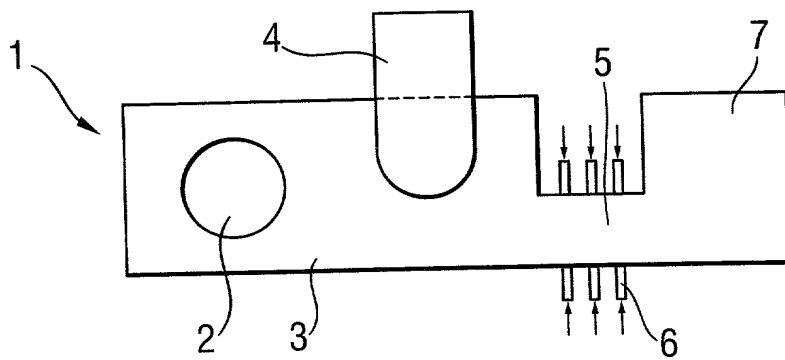
**Fig. 1**



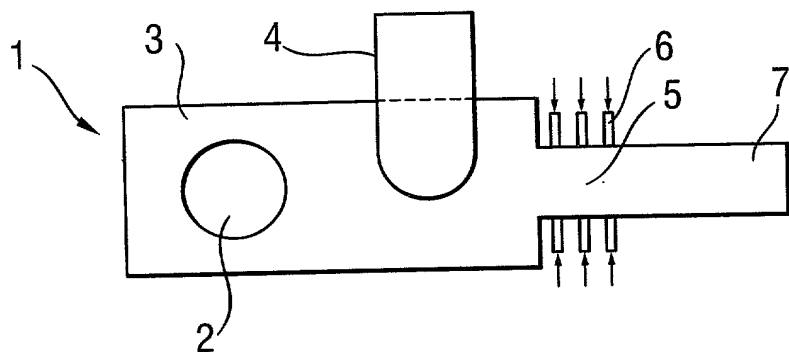
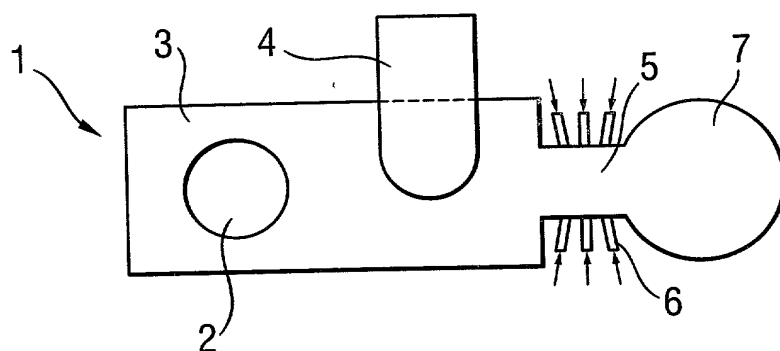
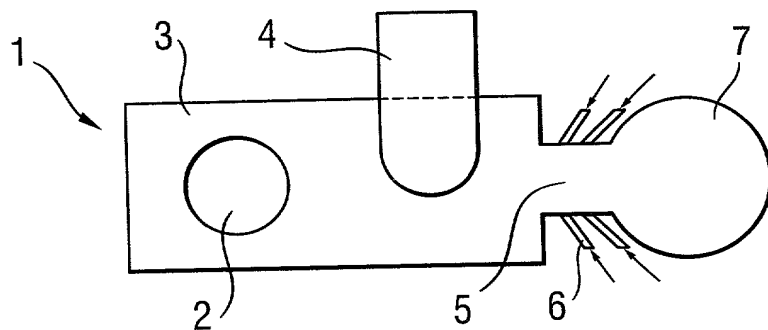
**Fig. 2**



**Fig. 3**



**Fig. 4**

***Fig. 5******Fig. 6******Fig. 7***

991110 05

Docket No. \_\_\_\_\_

COMBINED DECLARATION AND POWER OF ATTORNEY FOR  
ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL  
DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART APPLICATION

As a below name inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: Method and equipment for smelting non-ferrous metal sulphides in a suspension smelting furnace in order to produce matte of a high non-ferrous metal content and disposable slag  
the specification of which

a. ☐ is attached hereto

b. ☐ was filed on \_\_\_\_\_ as application Serial No. \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

PCT FILED APPLICATION ENTERING NATIONAL STATE

PCT/FI00/00396

c. ☒ was described and claimed in International Application No. \_\_\_\_\_ filed on \_\_\_\_\_ and as amended on \_\_\_\_\_ (if any). 4 May 2000

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby specify the following as the correspondence address to which all communications about this application are to be directed:

SEND CORRESPONDENCE TO: MORGAN & FINNEGAN, L.L.P.  
345 Park Avenue  
New York, N.Y. 10154

DIRECT TELEPHONE CALLS TO: \_\_\_\_\_  
(212) 758-4800

☐ I hereby claim foreign priority benefits under Title 35, United States Code § 119(a)-(d) or under § 365(b) of any foreign application(s) for patent or inventor's certificate or under § 365(a) of any PCT international application(s) designating at least one country other than the U.S. listed below and also have identified below such foreign application(s) for patent or inventor's certificate or such PCT international application(s) filed by me on the same subject matter having a filing date within twelve (12) months before that of the application on which priority is claimed:

☐ The attached 35 U.S.C. § 119 claim for priority for the application(s) listed below forms a part of this declaration.

<u>Country/PCT</u>	<u>Application Number</u>	<u>Date of filing (day, month, yr)</u>	<u>Date of Issue (day, month, yr)</u>	<u>Priority Claimed</u>
Finland	991110	14/05/1999		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
				<input type="checkbox"/> YES <input type="checkbox"/> NO
				<input type="checkbox"/> YES <input type="checkbox"/> NO

☐ I hereby claim the benefit under 35 U.S.C. § 119(e) of any U.S. provisional application(s) listed below.

Provisional Application No.

Date of Filing (day, month, yr)

**ADDITIONAL STATEMENTS FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART OR PCT INTERNATIONAL APPLICATION(S) (DESIGNATING THE U.S.)**

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s) or under § 365(c) of any PCT international application(s) designating the U.S. listed below.

<u>US/PCT Application Serial No.</u>	<u>Filing Date</u>	<u>Status (patented, pending, abandoned)/ U.S. application no. assigned (For PCT)</u>
<u>US/PCT Application Serial No.</u>	<u>Filing Date</u>	<u>Status (patented, pending, abandoned)/ U.S. application no. assigned (For PCT)</u>

☐ In this continuation-in-part application, insofar as the subject matter of any of the claims of this application is not disclosed in the above listed prior United States or PCT international application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or Imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorneys and/or agents with full power of substitution and revocation, to prosecute this application, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith: John A. Diaz (Reg. No. 19,550), John C. Vassil (Reg. No. 19,098), Alfred P. Ewert (Reg. No. 19,887), David H. Pfeffer (Reg. No. 19,825), Harry C. Marcus (Reg. No. 22,390), Robert E. Paulson (Reg. No. 21,046), Stephen R. Smith (Reg. No. 22,615), Kurt E. Richter (Reg. No. 24,052), J. Robert Dailey (Reg. No. 27,434), Eugene Moroz (Reg. No. 25,237), John F. Sweeney (Reg. No. 27,471), Arnold I. Rady (Reg. No. 26,601), Christopher A.

Hughes (Reg. No. 26,914), William S. Feiler (Reg. No. 26,728), Joseph A. Calvaruso (Reg. No. 28,287), James W. Gould (Reg. No. 28,859), Richard C. Komson (Reg. No. 27,913), Israel Blum (Reg. No. 26,710), Bartholomew Verdirame (Reg. No. 28,483), Maria C.H. Lin (reg. No. 29,323), Joseph A. DeGirolamo (Reg. No. 28,595), Michael A. Nicodema (Reg. No. 33,199), Michael P. Dougherty (Reg. No. 32,730), Seth J. Atlas (Reg. No. 32,454), Andrew M. Riddles (Reg. No. 31,657), Bruce D. DeRenzi (Reg. No. 33,676), Michael M. Murray (Reg. No. 32,537), Mark J. Abate (Reg. No. 32,527), Alfred L. Haffner, Jr. (Reg. No. 18,919), Harold Haidt (Reg. No. 17,509), John T. Gallagher (Reg. No. 35,516), Steven F. Meyer (Reg. No. 35,613) and Kenneth H. Sonnenfeld (Reg. No. 33,285) of Morgan & Finnegan, L.L.P. whose address is: 345 Park Avenue, New York, New York, 10154; and Edward A. Pennington (Reg. No. 32,588), Michael S. Marcus (Reg. No. 31,727) and John E. Hoel (Reg. No. 26,279) of Morgan & Finnegan, L.L.P., whose address is 1775 Eye Street, Suite 400, Washington, D.C. 20006.

[ ] I hereby authorize the U.S. attorneys and/or agents named hereinabove to accept and follow instructions from Outokumpu Oyj, Espoo, Finland as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and/or agents and me. In the event of a change in the person(s) from whom instructions may be taken I will so notify the U.S. attorneys and/or agents hereinabove.

Full name of sole or first inventor KOJO, Ilkka  
Inventor's signature\* [Signature] 24 April 2002  
date  
Residence Kaksosmäki 11 C 9, Kirkkonummi, Finland  
Citizenship Finnish FIX  
Post Office Address Kaksosmäki 11 C 9, FIN-02400 Kirkkonummi, Finland

Full name of second joint inventor, if any KYTÖ, Markku  
Inventor's signature\* [Signature] 24 April 2002  
date  
Residence Tornitaso 2 B, Espoo, Finland  
Citizenship Finnish FIX  
Post Office Address Tornitaso 2 B, FIN-02100 Espoo, Finland

[ ] ATTACHED IS ADDED PAGE TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR SIGNATURE BY THIRD AND SUBSEQUENT INVENTORS FORM.

\* Before signing this declaration, each person signing must:

1. Review the declaration and verify the correctness of all information therein; and
2. Review the specification and the claims, including any amendments made to the claims.

After the declaration is signed, the specification and claims are not to be altered.



To the inventor(s):

The following are cited in or pertinent to the declaration attached to the accompanying application:

Title 37, Code of Federal Regulation, § 1.56

Duty to disclose information material to patentability.

(a) A patent by its very nature is affect with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

Title 35, U.S. Code § 101

Inventions patentable

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Title 35 U.S. Code § 102

Conditions for patentability; novelty and loss of right to patent

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent,

(b) the invention was patented or described in a printed publication in this or foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States, or

(c) he has abandoned the invention, or

(d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent, or

(f) he did not himself invent the subject matter sought to be patented, or

(g) before the applicant's invention thereof the invention was made in this country by another had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other ...

#### Title 35, U.S. Code § 103

##### Conditions for patentability; non-obvious subject matter

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

#### Title 35, U.S. Code § 112 (in part)

##### Specification

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise and exact terms also enable any person skilled in the art to which it pertains, or with which it is mostly nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

#### Title 35, U.S. Code § 119

##### Benefit of earlier filing date in foreign country; right of priority

An application for patent for an invention filed in this country by any person who has, or whose legal representatives or assigns have, previously regularly filed an application for a patent for the same invention in a foreign country which affords similar privileges in the case of applications filed in the United States or to citizens of the United States, shall have the same effect as the same application would have if filed in this country on the date on which the application for patent for the same invention was first filed in such foreign country, if the application in

this country is filed within twelve months from the earliest date on which such foreign application was filed; but no patent shall be granted on any application for patent for an invention which had been patented or described in a printed publication in any country more than one year before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country more than one year prior to such filing.

Title 35, U.S. Code § 120

Benefit or earlier filing date in the United States

An application for patent for an invention disclosed in the manner provided by the first paragraph of section 112 of this title in an application previously filed in the United States, or as provided by section 363 of this title, which is filed by an inventor or inventors named in the previously filed application shall have the same effect, as to such invention, as though filed on the date of the prior application, if filed before the patenting or abandonment of or termination of proceedings on the first application or an application similarly entitled to the benefit of the filing date of the first application and if it contains or is amended to contain a specific reference to the earlier filed application.

Please read carefully before signing the Declaration attached to the accompanying Application.

If you have any questions, please contact Morgan & Finnegan, L.L.P.

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